

## 4.3

# Elastic and Inelastic Collisions

Momentum is conserved in the two collisions pictured in Figure 4.12, but the two cases are quite different. When the metal spheres in the Newton's cradle collided, both momentum and kinetic energy were conserved. When the cars in the photograph crashed, kinetic energy was *not* conserved. This feature divides all collisions into two classes. Collisions in which kinetic energy is conserved are said to be **elastic**. When kinetic energy is *not* conserved, the collisions are **inelastic**.



**Figure 4.12**

How do the collisions pictured here differ from each other?



### SECTION EXPECTATIONS

- Distinguish between elastic and inelastic collisions.
- Define and describe the concepts related to momentum, energy, and elastic and inelastic collisions.
- Investigate the laws of conservation of momentum and of energy in one and two dimensions.

### KEY TERMS

- elastic
- inelastic

## Analyzing Collisions

You can determine whether a collision is elastic or inelastic by calculating both the momentum and the kinetic energy before and after the collision. Since momentum is always conserved at the instant of the collision, you can use the law of conservation of momentum to find unknown values for velocity. Then, use the known and calculated values for velocity to calculate the total kinetic energy before and after the collision. You will probably recall that the equation for kinetic energy is  $E = \frac{1}{2}mv^2$ .